

Appendix E

Property Values Feasibility Studies Decision Insights, Inc.

Decision Insights, Inc.

February 15, 1999 DRAFT

PROPERTY VALUES REQUEST FOR PROPOSAL

R. Gregory, Value Scope Research
Detlof von Winterfeldt, Decision Insights, Inc.

INTRODUCTION

The California Department of Health Services (CDHS) has contracted with Decision Insights, Inc. to conduct a project "Power Grid and Land Use Policy Analysis". The purpose of this project is to provide policy makers with tools to evaluate alternative policies for managing electromagnetic fields (EMF) exposure in the light of the uncertainties surrounding an EMF-health effects association.

An important aspect of this study concerns the effects of the EMF issue on the values of properties near transmission and distribution lines. Preliminary sensitivity analyses indicate that this effect could be significant, especially if future research were to support an EMF-health effect link. It is therefore important to obtain better estimates of the impact of EMF exposure on property values.

However, it is unclear how such estimates can be obtained and how much a study that provides defensible estimates of impacts would cost. To obtain a better understanding of these issues, Decision Insights was asked to provide a "feasibility study" of the possible effects of EMF exposure on property values.

To initiate this feasibility study, Decision Insights, Inc. proposed to contract with Parkcenter Reality Advisors (PRA), a well-known real estate appraisal firm in Southern California. Furthermore, in discussions with the staff of PRA, the idea emerged to develop the feasibility study by asking PRA to respond to a mock "Request for Proposal", that would specify the requirements of the project. By responding to this mock RfP, complete with work plan and budget, the project would get a better understanding of the feasibility of a property values study. Following is the mock RfP.

“REQUEST FOR PROPOSALS”

Impact of Electromagnetic Fields Exposure from Transmission and Distribution Lines on Property Values Department of Health Services, California

The State of California, Department of Health Services, as part of its ongoing examination of the possible effects of electromagnetic fields from transmission and distribution lines, requests a study that examines the impact of EMF exposure from transmission and distribution lines on property values. The purpose of the project is to estimate the relationship between EMF exposure and the value of residential or commercial property. The proposal should include: a theoretical framework for evaluating property value effects of EMF exposure, a brief review of previous work on the topic, a description of the empirical approaches that will be used to estimate the effects of EMF exposure on property values, and a clear identification of the costs and timeline associated with the proposed project.

Background and Goals

Public concern about possible health risks from EMF exposure from power lines has led to difficult questions for scientists and public officials. This concern centers on evidence regarding the possibility that exposure to residential electric and magnetic fields may increase an individual's risk from cancer or lead to adverse reproductive, developmental, or neurobehavioral effects. Despite mixed scientific results, this concern may, in turn, have led to measurable reductions in the value of residential and commercial properties in the vicinity of power lines.

The purpose of this request for proposals is to solicit a study that will address this possibility in an effective and comprehensive manner, providing information to decision makers about the potential magnitude of reduced property values as well as the implications of public concerns for n-litigation initiatives.

Tasks

The ultimate objective of the requested study is to determine the reduction in property values (if any) in residential and commercial properties exposed to magnetic fields from power lines. Since it is expected that there is some devaluation of properties in the vicinity of power lines due to aesthetics, noise, and radio interference, the study should try to disentangle the EW effect of property depreciation from these other effects. Specifically, the proposed study should:

1. Provide reliable estimates of property value impacts as a function of the exposure to EMFs (determined by direct measurement, wire codes, or distance), type of structures (e.g., lattice vs. poles), and location of lines (e.g., on right-of ways vs. streets).

2. Determine the relative magnitude of property value impacts due to EMF (measured exposure, wire codes, distance) vs. non-EMF effects (aesthetics, noise, and radio interference).
3. Determine the EMF effects on property values for different land uses (e.g., residential, commercial, industrial).
4. Estimate the magnitude of the effects of E@ on property values depending on the resolution of research about an EMF-health link. In particular, three scenarios should be studied: research proves that there is a serious health effect, research proves that there is no health effect, and research remains inconclusive.

Complicating Issues

The possible relationship between EMF exposure and property values is very complex. Stakeholder advisors of the CDHS have raised the following issues that a study should address. The proposal should discuss these issues and state how they are resolved by the proposed methods. If the problems cannot be resolved, the proposal should state how second best methods could be used and what their shortcomings are.

EMF exposure can be measured in different ways e.g., by wire code, distance from the lines, measurements near the house, and in-house measurements? How will the study use these multiple exposure measures?

Different EMF exposure metrics have been proposed (e.g., time weighted average, thresholds, rapid changes). What is the feasibility of using these different measures?

It is possible that property values are affected more by perceived exposure than by actual exposure. How will the study address the difference between perceived and actual exposure?

Is it necessary to categorize homes in terms of aesthetics, noise, and radio-interference?

How will the study separate overhead and underground transmission and distribution lines?

How will the study assure blind categorization or measurement of the independent and dependent variables?

What sample size will be required to detect a 5% difference in property values (at an alpha level of .05 with sufficient power)?

How will the study address the three scenarios (research proves that there are no health effects, research proves that there are serious health effects, research remains inconclusive?)

Multi-Method Approach

In order to complete these tasks in a defensible manner, the project should use multiple convergent approaches including the following:

Appraisal method. In this method, actual sales prices of houses near a transmission or distribution line will be compared to matched houses at a substantial distance (more than 500 feet) from the lines. The study might also look at sales of tract (i.e., more densely spaced) homes rather than individual, more dispersed sales. Depending on the quality of information obtained on housing stock characteristics and the comparability of the matched samples, it may be easier to (a) conduct a hedonic pricing study or (b) complete statistical tests of market sales data.

Market value method. In this method, historical records of home sales are subjected to statistical analysis. For example, a regression study could be designed to improve policy makers' understanding of the relevant price elasticity of demand for houses. Alternatively, structural modeling techniques could be used to develop a model of the relationship among key variables that are thought to affect property values.

Survey method. This method would study potential home buyers in California to establish their base level of knowledge regarding EMF effects, their understanding of the cost and efficacy of alternative mitigation options (such as moving lines, undergrounding or reconfiguring lines, etc.) as well as their understanding of EMF-exposure sources (e.g., do people understand that grounding for homes via water pipes produces EMF exposure?). This survey should also obtain potential buyers' willingness to pay for properties near powerlines vs. properties at a distance from powerlines. Characteristics of powerlines (EMF exposure, aesthetics, noise, radio interference) should be controlled. Sample size and power issue should be discussed.

While a specific proposal does not necessarily have to include all three methods, it should address the pros and cons of each method, and provide examples of studies that have used the same or similar approaches as the one proposed.

Coordination with CDHS and public stakeholders

The project will be supervised by the CDHS with advice from a stakeholder advisory committee (SAC). The proposal should provide a plan for addressing issues of stakeholder communication as part of the conduct of the study. This emphasis on communication is designed to ensure timely dissemination of, and visibility for, the study efforts as well as to help ensure that the concerns of key stakeholder groups are meaningfully addressed.

Agency contacts

Proposals should be sent to

Detlof von Winterfeldt
Decision Insights, Inc.
2062 Business Center Drive
Irvine, CA 92651
(949) 474 7303 xl

Proposal Format

The proposal should not exceed 15 single spaced pages, excluding biographical material and budget pages. The proposal should include the following items:

1. Cover Page
2. Summary (1 page)
3. Introduction
4. Brief Review of Literature
5. Proposed Methods
6. Study Plan
7. Data Analysis Plan
8. References
9. Staffing Plan
10. Schedule
11. Budget

Deadline for Submitting Proposals

All proposals should be received on or before 5:00 pm PST, March 15, 1999.

Contract Period

The designated contract period is two years from the date of the award.

Criteria Used to Evaluate Proposals

All proposals appropriately signed and received by the deadline that address the four tasks outlined in this RfP will be evaluated in accordance with the following 100 point scale:

1. Probability of successful completion of tasks 1-4: 30 points
2. Quality of the proposed multi-method approach: 30 points

3. Qualifications and experience of the personnel and company: 20 points
4. Budget level and cost detail: 10 points
5. Overall clarity and ease of comprehension of proposal: 10 points

Disclaimer

This is a mock RFP. Its intent is to solicit a proposal from a single organization (Parkcenter Reality Advisors) in order to assess the technical and financial feasibility of an EMF property evaluation study. At this time, there is no intention to fund the proposal submitted by PRA or any other proposal submitted on this topic to the CDHS.

Proposal for:

*FEASIBILITY STUDY TO MEASURE THE
IMPACT OF ELECTROMAGNETIC FIELDS EXPOSURE (EMF)
FROM TRANSMISSION AND DISTRIBUTION LINES
ON PROPERTY VALUES*

Submitted to:

Detlof von Winterfeldt, Ph.D.
President
DECISION INSIGHTS, INC
2062 Business Center Drive, Suite 110
Irvine, California 92612

Submitted by:

PARKCENTER REALTY ADVISORS
801 North Parkcenter Drive, Suite 210
Santa Ana, California 92705

PRA File No. 99-13-1

Date Submitted:
March 12, 1999

PARKCENTER REALTY ADVISORS

Appraisers and Consultants
Siite 210

801 North Parkcenter Drive

Santa Ana, CA 92705
(714) 547-1733
(714) 972-1492 FAX

March 12,1999

DECISION INSIGHTS, INC
2062 Business Center Drive, Suite I 10
Irvine, California 9261

Attention: Mr. Detlof von Winterfeldt, Ph.D. President

Reference: Feasibility Study To Measure The Impact Of
Electromagnetic Fields Exposure (EMF) From
Transmission And Distribution Lines On Property Values

PRA File No. 99-13-1

Gentlemen:

In response to your "Mock Request For Proposal", we are pleased to provide the enclosed suzoested outline for a property values study relating to the potential impact of EIMF exposure on various types of real estate in California. We look for-ward to receiving responses from the California Department of Health Services and its Stakeholder Advisory Committee, at which time we will follow with a revised proposal.

Respectfully submitted,

PARKCENTER REALTY ADVISORS

By:

Christopher N. Hardy, MAI

Senior Vice President

Certified General Real Estate Appraiser
State of California No. AGOO'@.'169

CNH:pmd

SUMMARY

At your request, Parkcenter Realty Advisors is pleased to present this proposal to identify parameters and procedures to be used in performing a comprehensive study and analysis of the impact and effects of Electromagnetic Fields Exposure (EMF) on the market value of various types of real property located near transmission and distribution lines throughout the state of California. We understand that the proposal is to be incorporated as part of a study to be performed by Decision Insights, Inc. under contract to the California Department of Health Services, entitled "Power Grid and Land Use Policy Analysis". Parkcenter Realty Advisors, through submission of this proposal, offers a theoretical framework for evaluating the effects on property values from EMF exposure; a brief review of previous work on the topic; a description of the empirical approaches and appraisal methodology that could be used to estimate the effects of EMF exposure on property values; and an estimate of the costs and time line associated with performing such an analysis.

The purpose of the valuation analysis is to provide information to decision makers about the potential magnitude of reduced property values as well as the implications of public concerns for mitigation initiatives. Toward this end, procedures and methodologies outlined in this proposal are intended to result in a study which will provide a better assessment of the effects of EMF on property values than have been offered by similar studies performed to date. In order to accomplish these results, the property value impact study is to address areas of specific concern by providing, if possible a means of:

- a) arriving at reliable estimates of the impact on property value expressed as a function of the exposure to EMF's (determined by direct measurement, wire codes or distance), type of structures (e.g., lattice versus poles), and location of lines (e.g., on right-of-ways versus streets);
- b) quantifying the relative magnitude of property value impacts due to EMF (measured exposure, wire codes, distance) versus non-EMF effects (aesthetics, noise and radio interference);
- c) determining the EMF effects on property values for different land uses (e.g., residential, commercial, industrial); and,
- d) estimating the magnitude of the effects of EMF on property values depending on the resolution of research about an EMF-health link. In particular, three scenarios should be studied: research proves that there is a serious health effect; research proves that there is no health effect; and research remains inconclusive.

Please be advised that as with any independent and unbiased appraisal or feasibility study, the role of the appraiser in studying the market is to investigate, analyze and draw supportable conclusions which are a reflection of the attitudes of buyers and sellers of real estate in the market. Accordingly, while the methodology and suggested analyses recommended in this proposal represent our best estimates of appropriate means to address the specific areas of concern stated, no assurance can be given with respect to the degree or adequacy of available market evidence, or the nature of the conclusions drawn.

INTRODUCTION

In performing the appraisal process, an appraiser is normally concerned with developing and analyzing information which may be classified into one of three primary categories pertaining to the property which is subject to the appraisal: the site, the improvements, and the area or neighborhood in which the property is located. As referenced in The Appraisal of Real Estate published by the Appraisal Institute, environmental conditions are one of four basic forces which may influence value by impacting the neighborhood of a property or its geographic location, and may be either natural or man-made. Nuisances and hazards are listed as important environmental considerations to be taken into account when performing a real estate appraisal, and may otherwise be referred to as environmental liabilities or environmental impairments.⁽¹⁾

Traditionally, there has been a lack of uniformity in opinion and scientific evidence as to the classification and recognition of EMF exposure as simply a nuisance or a more serious environmental hazard. In cases where there is well publicized evidence as to the hazardous nature of a substance, such as asbestos, radon, lead paint or other toxic material, recognized appraisal education authorities like the Appraisal Institute have developed positions and advice on the role of appraisers in dealing with such hazardous substances in development of an appraisal, and applicability of the Uniform Standards of Professional Appraisal Practice⁽²⁾. With respect to EMF exposure, however, there appears to be little consensus among the real estate community, and appraisal authorities in particular, that EMF exposure actually constitutes a hazardous condition. In its voluntary Guideline, *Property Observation Checklist*, made available for use by appraisers during inspection of a property being appraised, the Appraisal Institute provides a written checklist of "possible environmental factors observed by the appraiser", and lists as one possibility the presence of transmission towers (electrical or microwave) on the subject property, or adjoining properties.⁽³⁾ No further implications or recommendations in dealing with the presence of such structures is offered. The publication merely states the intention of the checklist to be a limited scope analysis to identify possible environmental factors that could be observable by a non-environmental professional...to be used only to assist the appraiser's client in determining whether an environmental professional is required. As further evidence of the lack of recognition and consensus of the status of EMF radiation as a hazardous substance, two large institutional lenders who have required inclusion of a preliminary environmental survey or checklist as part of an appraisal report, fail to specify EMF as a condition of concern on their forms, listing instead such items as asbestos; underground storage tanks, drums or pipelines; PCB-containing materials; wastewater; and pesticides/herbicides, among others⁽⁴⁾⁽⁵⁾. Finally, in our experience and observation, identification and investigation of EMF exposure is typically not an area which is even addressed by environmental professionals in a "Phase One" Environmental Site Assessment to determine potential for environmental liabilities.

In cases where there is consensus reached as to the identity and hazardous nature of substances, methods of addressing and measuring the impact of the presence of such conditions on property values have developed. Such methods normally are the result of an expressed need through reactions in the market, reflecting a combination of public awareness and concern, government mandated abatement policies, legal basis and liability for necessity of cleanup or correction, or inability to obtain financing or insurance, all of which may negatively impact the property's market

value. In the case of EMF exposure, however, to date there has been a lack of legal necessity and overwhelming market concern or awareness to warrant development of a suggested uniform methodology in measuring the potential impact on a property's market value in the type of detail sought through request for this proposal. The above does not mean that if EMF exposure should prove to be a significant health threat in the future, that it will be ignored. Indeed, the asbestos issue came rapidly to the forefront when it was brought to light in the early 1980s, for instance.

BRIEF REVIEW OF LITERATURE

A review of available papers and studies that have been conducted on this issue over the years indicates such a mixture of conclusions and results that no clear consensus is available, except perhaps through criticism, by some, of the methodologies and analysis techniques used. Rather than a comprehensive overview of the significant volume of published material dealing with various attempts to verify and quantify the impact of EMF exposure on property values, we have focused on some of the studies and writings that we consider to be most relevant to the suggested approaches to be made in this proposal. One of the most interesting, as it relates to the focus and function of this proposal, is the study conducted by Kung and Seale on residential properties in Memphis and Shelby County, Tennessee.⁽⁶⁾ Similar to other studies published over the previous years, it tested the hypothesis that power transmission lines may adversely affect property values or marketability merely by the presence of the towers, which create eyesores as well as easements and encroachments on property. However, this study varied significantly from earlier works by also attempting to identify the extent of public perception of the potential link between EMF radiation and health risks, and the impact that these perceptions had on the value of homes located near power transmission lines. Thus, the study presents an attempt to separately identify and measure the aesthetic and potential health hazard impacts of the EMF/transmission line issue. Methodology employed was a combination of homeowner surveys and analysis of sales data involving homes within the same neighborhoods, some directly impacted by proximity to power transmission lines and others located farther away. Results of the study were mixed and somewhat inconclusive, since very little public awareness or concern was evident with regard to EMF health related issues and there was no corresponding negative influence on home prices. On the other hand, the survey responses seemed to indicate that a different attitude toward property value would result given conclusive evidence and knowledge of potential health risks.

With the most recent publications of the studies and writings of Randall Bell, MAI, it now appears that the Appraisal Institute may be endorsing the notion that EMF/transmission lines comprise a "detrimental condition" impacting real estate values. In his "Detrimental Conditions" thesis presented at the Appraisal Institute National Symposium in Washington, D.C. on June 22, 1997, Bell expanded on his *Bell Chart*⁽⁷⁾ theory by referring to EMF as one of over 200 Detrimental Conditions (DCs) which could be placed within one of ten standard categories, as a means of classifying the impact and determining appropriate appraisal methodology to be employed in performing an accurate assessment of the detrimental condition on the property's market value. Bell indirectly seems to equate EMF exposure and power transmission lines as being one in the same, classified as a Class V-Imposed Condition. In the *Bell Chart*, EMF is referenced as one of nine conditions which are lumped under the heading "Neighborhood Nuisance", the others being sewage

plants, power plants, nuclear plants, blight, illegal use, jails, traffic noise and airport noise. Later, in his discussion, Bell borrows from the earlier work of Kung and Seagle by stating that Class V conditions involve "adverse external factors" such as "dumps, landfills, factories that produce noise and bad odors, neighbors that allow their property to deteriorate, and transmission lines." Separate classifications are presented for environmental conditions such as soil contamination, and toxic or hazardous waste that may be economically and physically repaired (VIII); and for the most serious situations involving many of the conditions that cannot be economically or physically remedied (X)' Bell does not mention or allude to the possibility that EMF exposure, if known to be linked to health risks, may be viewed differently from the standpoint of its classification as a detrimental condition and the manner 'in which its valuation impact is estimated. This may be an indication of the current lack of both public and professional perception of hazards associated with EMF exposure. Regardless, Bell continues to present his opinion that a valuation model applicable to all detrimental conditions involves analysis of six basic elements: estimated value of the property unaffected by the condition-, costs or losses associated with assessment of the condition; repair and remediation costs, ongoing costs; market resistance; and value of the property as impacted by the detrimental condition. He is quick to point out, however, that a detrimental condition could be completely benign, and that each situation must be independently and competently analyzed. Bell offers the opinion that the key in estimating and quantifying diminution in value due to detrimental conditions is the collection and analysis of market data, and is a proponent of paired-sales analysis, involving the process of comparing sales affected by a detrimental condition with similar sales not affected by a detrimental condition.⁽⁸⁾

Other earlier studies performed in the 1960s and 1970s employed combinations and variations of the sales comparison approach and survey data in attempts to quantify, the impact of transmission lines on property values. One extensive study, in particular, by Dr. Kinnard, drew both subsequent support and criticism over the issues of adequacy or inadequacy of analysis of the sales data, particularly in terms of isolating other variables besides the transmission line condition, and potentially biased nature of some of the survey participants.⁽¹⁰⁾⁽¹¹⁾ In our opinion, this points out the critical issue concerning comparability of the paired sales data when employing the Sales Comparison Approach, and in being able to effectively isolate the extraneous variables that are not associated with the EMF/transmission line condition when analyzing and drawing conclusions from the data.

PROPOSED METHODS

One of the primary difficulties in attempting to analyze the *potential* impact of EMF exposure on property values is the inability to draw effective analogies to the property value impact experiences associated with other forms of proven environmental hazards, like asbestos, radon and toxic soil contamination. In these instances, the environmental hazards are present within the impacted property, and a certain liability exists with the property owner to rectify the hazardous condition. EMF radiation, by its very nature, is an environmental liability external to the proper-ties which are potentially impacted. Hence, one of the major factors leading to diminution in an effected property's value, liability for assuming the cost of correction, is missing. Presumably, if future scientific studies prove a link between EMF radiation and cancer or other health defects, causing

governmental mandates for dealing with the problem, liability would most likely lie with the utility companies and not the impacted property owners. Likewise, estimating the potential impact of EMF radiation by comparison to other forms of environmental nuisances, like landfills and airport overflight flight zones, may not be an entirely appropriate comparison either. While such environmental impairments certainly present potential nuisances to nearby properties in terms of noise, odor and view impairment, such impacted properties may not experience the same degree of risk due to health uncertainties, as do proper-ties impacted by EMF exposure.

The previous observations concerning the dissimilarities of EMF exposure to other forms of environmental hazards or nuisances, however, does not mean that familiarity with these conditions and related impacts on market values of properties cannot be helpful. On the contrary, it is our opinion that methods which we have used previously in cases involving the potential impact on market value of airport noise and proximity of property to public landfills, are directly applicable. In each case, the primary methodology employed use of the Sales Comparison Approach, involving the Gathering, verification and analysis of sales of both impacted and unaffected properties as a measure of diminution in value from the condition. Our proposal to study the impact of EMF exposure on property values would also include the recommendation for an extensive survey designed to detect specific attitudes, awareness and perceptions of both buyers and sellers in the market.

Direct sales comparisons will be particularly applicable to the valuation of single-family residences. The basic analysis will be to compare sales data within direct proximity to power transmission lines (study area proper-ties) to sales data within the same or similar tracts, but far enough removed from the transmission lines to be unaffected (control areas). Of critical importance in the gathering and understanding of the data will be verification inter-views conducted with buyers and sellers of impacted homes within the study areas to determine their attitudes., awareness and concerns with respect to the EMF issue, and how the price paid for the home may have been impacted as a result. It is anticipated that similar survey information will be sought from buyers and sellers of homes in the control areas as well, to see if any preference attitudes can be detected which have a bearing on the relative values of study versus control area properties. We propose to analyze the data by comparing overall price levels, prices per square foot, absorption patterns and rates, and price appreciation rates for homes in the impacted and control tracts. Identification of specific reasons associated with changes in property value levels or patterns noted between the study areas and control areas will involve integrating results of the buyer/seller verification interviews and the survey results.

In the case of commercial properties or income-producing residential properties, comparative valuation methodology will involve comparison of sale prices, rental rates and occupancy levels of study area proper-ties versus control area properties. Again, buyer/seller verification inter-views are expected to be critically important and particularly insightful in the valuation analysis.

Foremost in our approach to defining the scope in methodology for the proposed property value impact study is distinguishing between diminution in value which may be the result of nuisance issues versus those attributable to health risk concerns. In our opinion, the current lack of public awareness and concern associated with *potential* health risks related to EMF exposure may

make it extremely difficult to quantify meaningful results which could be supported by market evidence. Our experience would lead us to suspect that the market is not sophisticated enough, or sufficiently knowledgeable regarding scientific evidence which may or may not exist, to consciously pay lower prices for properties specifically for reasons of health risk concerns. The history associated with other properties impacted by other hazardous materials, like asbestos, for instance, suggests that support for quantifiable evidence of diminution in value has normally only appeared after widespread publication of undisputed scientific evidence, government mandated abatement policies and establishment of legal liability.

In summary, our analysis of the market can only reflect current perceptions and attitudes of buyers and sellers as they impact property values. Although we understand the concern and desire to quantify the impact on property values of undisputed evidence which may someday link EMF radiation to serious health problems, such measurements cannot be derived from the market until they actually occur. Some of the primary determinants of diminution in value due to detrimental conditions, as pointed out in the studies and theories referred to earlier by Randall Bell, are costs associated with assessment of the condition, repair and remediation costs, ongoing costs and market resistance. These are all unique not only to the type of detrimental condition but to the specific property and cannot be forecast with any degree of accuracy. Nuisance issues dealing with aesthetics, noise, radio interference and view impairment are likely to be more readily identifiable by available and defensible market evidence. Some element of perceived health risk may also be reflected in the market evidence, but may be difficult to separately quantify and we suspect will be heavily dependent on the technical awareness of specific buyers. In the end, we believe that a comprehensive study which focuses on developing high quality, detailed data reflecting closely comparable study area and control area properties will be more useful and defensible in terms of the conclusions rendered than a broad mass statistical analysis.

STUDY PLAN

Development of a precise study plan must address the objective of the report, "to determine the reduction in property values (if any) in residential and commercial properties exposed to magnetic fields from power lines." Within this relatively compact statement are a host of issues that contribute toward a very complex and challenging appraisal assignment. Following is a summary of implied areas of focus.

- Residential properties typically focus on single-family homes and apartments, but could also include condominiums, mobile home parks and retirement homes, among others. Different appraisal methodologies and separate market investigations are required in the appraisal of each.
- "Commercial properties" is a broad, undefined term which is typically used to describe nearly every type of property that is not residential or industrial. Office buildings, retail stores, shopping centers, theaters, auto dealerships, auto repair shops, supermarkets, drugstores, restaurants, and even private schools and day care centers are some of the specific property types which could be defined as commercial

- properties. Again, different appraisal methodologies and market investigations are required in the appraisal of each.
- It is a fact that the largest single influence on property values is location. Since power transmission lines exist all throughout the state of California and the recipient of the study is to be the California Department of Health Services, the assignment as defined holds the potential to comprise a route along every power line throughout the state of California.
- Conspicuous by their absence in not being specifically identified as part of a comprehensive study are governmental, institutional and public buildings which may potentially have some of the greatest risk factors and consequences of any of the property types categorized as either residential or commercial. These would include public schools, churches, government offices, and hospitals. Similarly, agricultural land, particularly land utilized for growing of food crops or in support of dairy farms, poultry ranches and other ingested food products, also would appear to have potential risk factors associated with EMF.

Obviously, a more limited focus and practical methodology must be pursued in order for the proposed scope of work to be meaningful, manageable and economically feasible. We have chosen to define a scope of work for the project which will focus on identifying property types which, in our opinion, exhibit the highest probability of being impacted by the detrimental conditions, and for which meaningful conclusions may be drawn.

Residential Properties

- The study should focus on single-family homes as one of the primary property types. In our opinion, homes are likely to be one of the most heavily impacted property types both from the standpoint of nuisance impact and any measurable health concern impact. We would propose that the study might identify no more than five impacted areas throughout the state which exhibit diverse geographic and price level characteristics. For instance, the five locations might be spread among Orange or Los Angeles Counties, San Diego County or the Inland Empire, and East San Francisco Bay and Metropolitan Sacramento. Focus on new housing tracts would likely yield the best results in terms of identifying meaningful study and control groups and ability to identify and adjust for variables in property characteristics that need to be factored out in order to isolate the impact of EMF/transmission lines. Since impact on value is likely to be affected by the price level of homes and economic status of buyers, projects which distinguish between entry level, move-up market, and estate homes may want to be considered. The proposed method of performing the study would be a combination of market sale comparisons between homes in the same or similar tracts, distinguishing between affected properties and non-impacted control homes; and survey of buyers and sellers/developers.

- In our opinion, it is possible that economic and residential market conditions may influence the results of the sales comparison program in attempting to identify and quantify whether homes are diminished in value due to their proximity to transmission lines. Specifically, market conditions reflecting strong housing demand and rising home prices may offset or negate pricing differential in the market between impacted and non-impacted homes. On the contrary, it is conceivable that when the opposite market conditions apply, the availability of alternative choices of non-impacted homes may cause a more noticeable distinction in value for the homes impacted by the detrimental condition. The study could be tailored to include comparisons as of past dates of value when market conditions were not as strong as they have been over recent years, but the market survey and data verification/analysis process would be more difficult due to the passage of time.
- Apartments, mobile home parks and retirement homes are less likely to exhibit loss in value than single-family homes, in our opinion. Occupancy is generally reflective of a rental situation and, in some cases, there may not be the same pride of ownership factors that weigh on the aesthetic concerns of homeowners which result from the proximity of transmission lines. If valuation of these types of residential properties is desired, the primary methodology would be the Income Approach which estimates value as the expectation of future benefits to be derived from rental income. EMF impact conditions would be very difficult to address on a generalized basis for these types of properties since land parcels are larger and improvements are spread out on the site, exhibiting different exposure characteristics depending on specific proximity, of the power transmission lines. In other words, each is unique. Case-by-case studies could be performed to determine if any rental or occupancy differentials existed within the property to allow for proximity of individual units or buildings to transmission lines. Capitalization of the net rent differentials would provide an estimate of diminution in value. However, it would be nearly impossible to translate results, thus, Generated to other similar use properties on a Generalized basis.

Commercial Properties

- EMF impact on commercial properties could be measured from the market, but would be extremely difficult, if not impossible, to apply in a Generalized manner to other commercial properties. For example, if for some reason only ten office suites within a 100-suite building are so seriously impacted by EMF transmission lines that they could not be occupied, theoretically the property might lose 10% of its value. However, this unique situation may not be applicable to every office building that suffers some detriment due to transmission line proximity. One other important distinction noted in the potential EMF impact on commercial property values versus homes is the possibility that an economical means of shielding could be applied to mitigate harmful exposure levels, thus, providing a measure of diminution in value through analysis of cost to cure. In this regard, it is possible that the more substantial materials typically used in commercial construction may already provide some form of effective shielding from EMF exposure. Our experience in the appraisal of radio

stations, for instance, indicates it is possible to achieve shielding for the broadcast studios from electrical static through use of thicker walls and higher rated insulation, and even lead panel inserts. However, until such time as scientific studies establish levels of harmful EMF exposure, the possibility and cost of shielding cannot be accurately addressed.

Industrial Properties

- In general, we have similar comments concerning industrial properties as were presented for commercial properties. Additionally, we offer the observation that industrial uses are perhaps least impacted by proximity to transmission lines and, in fact, may benefit from such proximity since there is considerable demand for large yards for trucking or storage usage which sometimes are even contained within the power line right-of-way area. In addition, with certain types of industrial properties, particularly warehouses or self-storage facilities, density of human occupancy is quite low, resulting in less concern related to potential health issues than for more heavily occupied structures.

Institutional and Governmental Buildings

- Such properties as schools, churches, hospitals and government buildings would naturally be a concern when assessing potential risk factors associated with EMF exposure because of the public occupancy ramifications. Yet, because these are considered to be special purpose properties, measurement of diminution in value due to this cause through comparison of market data would be extremely limited and difficult. Resultant conclusions would also be of questionable relevance in application to these special purpose properties on a generalized basis.

Agricultural Land

The study of agricultural land could include a comparison and analysis of both sales and lease rates for impacted and non-impacted farm land at several locations throughout the state of California. Of particular interest would be the comparison of ground lease rates for land within power transmission line right-of-ways used for Christmas tree farms, nursery stock growing, etc., versus similar lease rates for farm land which is not within the proximity of transmission lines. The loss of production could be reflected through an income capitalization process.

DATA ANALYSIS PLAN

If analysis of sample commercial and industrial properties for potential EMF impact on proper-tv values is desirable, methodology of data analysis will be a fairly straight forward comparison of sale prices per square foot, rental levels per square foot and overall occupancy rates between an impacted study property and non-impacted control properties. The same would be appropriate, in our opinion, for value impact analysis on agricultural land and governmental or institutional buildings.

In identifying and selecting the study and control areas and in analyzing the resultant sales, rental and occupancy comparisons, we will attempt to be sensitive to many complicating issues recognized in the Request For Proposal and listed in the attachments section of this response. However, we must caution that impacts of many of the EMF multiple exposure measures and exposure metrics may not be clearly distinguishable from the market data. Unless the measures are commonly recognized in the market by the participants, their ultimate impact on property values will not be specifically identifiable. We anticipate that the buyer/seller inter-interviews as well as other survey data will provide insight in this area. To this end, the survey and interview questions will be structured to ascertain levels of market concern and awareness of these topics. Other survey and interview questions can be included to determine the level of impact on value of perceived versus actual exposure.

With respect to single-family residential properties, distinguishing the characteristics of homes in the study area specifically for differences in aesthetics, noise and radio-interference probably cannot be accomplished with any degree of accuracy which will result in meaningful analysis of the study results. However, these items can also be covered in the survey and verification questions. Analysis of the data is anticipated to be handled differently than for studies involving commercial and industrial properties due to the volume of data expected to be generated and compared. We suggest analysis of the data first through comparison of arithmetic means of sale prices for homes in an identified, impacted study zone versus mean prices for highly comparable homes in the control areas. Units of comparison would be sale price per square foot of living area. Data would be categorized and compared for homes of the same floor plan within the same tract, which would greatly simplify adjustments required for size and physical features. Also, by selecting projects which would allow the study of periods involving the initial sellout of new tract homes, further uniformity of the quality and condition of the data could be realized. Depending on the information revealed in the buyer/seller interviews and market survey questionnaires, additional analysis of the data focusing on other independent variables other than power line distance could be presented. These may include potential factors previously discussed such as view impairment, health concerns, noise and radio interference. Data would be assembled into multiple data sets coinciding with the varied locations studied. One overall data set could also be analyzed.

If desired, a second analysis of trends in price differentials could be studied. In addition to analysis of sales data from a study tract over the period of initial sellout, the history of resales for the same homes over ensuing years could be studied to see if buyers attitudes toward the EMF condition experiences any changes over time. The trend in price differentials in the control area would be helpful in the comparative analysis.

STAFFING PLAN

The firm selected to perform an EMF property value analysis as outlined in this proposal should have sufficient size and staffing capability to accomplish the market research, data gathering and verification program, and analytical analysis "in-house" rather than by relying on subcontract appraisal services to perform these functions. This is better apt to ensure that proper control and supervision in administration of the assignment may be maintained, and will provide more continuity and quality assurance in gathering of the empirical data.

Supervising and staff appraisers contributing to the assignment should have broad experience in appraisal of a diverse variety of property types, over a wide geographic area of the state of California. Qualifications of a majority of the study contributors should include membership in the Appraisal Institute (MAI), considered to offer evidence of completion of the foremost in appraisal methodology training and experience, while maintaining strict adherence to the most rigorous ethical and performance standards in the appraisal industry; and also to hold a current certification as a Certified General Real Estate Appraiser in the state of California. It is also highly recommended that junior staff participants in the study hold either the designation as a Certified General or Certified Residential Real Estate Appraiser in the state of California, or at a minimum be Licensed as a Real Estate Appraiser in the state of California.

Felt to be of critical importance toward satisfactory performance of the complex assignment outlined, is demonstration of prior experience in appraisals involving the identification of "control groups" of properties (both affected and unaffected by conditions of the impact study), and utilization of effective and proper analysis of data and information processing resulting from the "control groups". This does not necessarily mean that the prior experience has to be in association with the EMF exposure issue addressed herein, but should be some sort of influence external to the property such as a landfill or toxic waste site, airport, nuclear power plant, or major transportation or utility corridor.

Parkcenter Realty Advisors is presented as being particularly qualified to undertake and successfully complete such an assignment given the size and competency of the staff, attainment of a high level of professional qualification and expertise, past appraisal experience involving properties in a variety of geographic locations throughout the state of California, and extensive experience in the study and appraisal of properties impacted by various external forces.

Three of the four principals of the company, Robert A. Steele, MAI, CRE; Christopher N. Hardy, MAI; and Clay S. Harris, MAI, hold designations as Members of the Appraisal Institute and as Certified General Real Estate Appraisers in the state of California. Marian L. Lamb is also a State of California Certified General Real Estate Appraiser. Further reference to statements of specific educational and experience backgrounds may be found in the attached Appraisal Qualifications summaries for each of the professional staff members.

During the past 12 to 18 months, we have performed appraisal and feasibility study assignments throughout California in the counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura, Santa Barbara, Tulare and Alameda. Over the years of our business association together, we have also been involved in appraisal assignments in such additional Northern California jurisdictions as San Francisco, Bakersfield, Tracy, Redding, Sacramento, Fresno, Santa Rosa and Danville.

Parkcenter Realty Advisors has had extensive experience in appraisal assignments involving the impact on value of neighboring properties from such external conditions as airport noise, construction defects, soil subsidence, landfills and utility corridors, all considered to be directly relevant in the identification and comparison of issues at hand concerning EMF exposure. In most cases, these assignments involved the analysis of large Groups of residential properties both as part of the study area and in the control areas. The performance of these assignments illustrates our ability and experience in the areas of administrative management, data gathering identification techniques and analysis methodologies, and ability to draw relevant conclusions pertaining to similar complex appraisal and feasibility assignments.

SCHEDULE

Our recommendation is for a total project period of not longer than 6 months. This is estimated to be the outside range of a reasonable period to perform the assignment and allow it to be incorporated into more comprehensive studies and recommendations involving public policy issues. Also, a six-month study and analysis period is felt to be advisable to ensure that the relevancy of market data and other empirical evidence used in the analysis is not overly impacted by changing demand patterns and attitudes in the real estate market. This means that a potential applicant to perform the EMF property value study must have sufficient staff resources to perform the study in a timely manner.

We would suggest that at least two and possibly three meetings be held between the appraisers, primary study contractor and representatives of the CDHS and stakeholder advisory committee during the course of the market study period. One would be advised at the beginning of the assignment to get acquainted and review the scope and proposed methodology. This is felt to be particularly important to define the extent of studies to be performed with respect to some of the non-residential property types mentioned. Within 30 to 45 days of the initial meeting, we would propose a second meeting to present our recommendations for selecting the study and control groups for the residential studies, and preliminary outline of specific questions and topics to be covered in our verification interviews and survey questionnaires. The purpose of this meeting is to allow final input for altering the study areas or interview questions before the extensive field work is started. The final meeting, if desired, would follow at the end of our market study and analysis in order to verbally present the findings and conclusions prior to issuance of the written report. This would be the final opportunity for input and observations before completion of the valuation study process.

BUDGET

An estimate of the fee to perform the EMF property value study as outlined is highly dependent on a number of factors which will need to be further specified and defined. Among these are the number of study properties to be included, location of the study properties, and extent of study involving other than single-family residential property types. A preliminary budget summary is presented as part of this proposal, reflecting the following assumptions. Please refer to the Estimated Budget Summary in the Attachments for details.

- Time and fee estimates for professional services assume an average rate of \$200 per hour, reflecting the fee schedule summarized in the Attachment section of this proposal.
- The study will include the identification and study of five residential study tracts, five commercial or industrial properties, and five parcels of agricultural land.
- Locations of the study properties will be in Northern and Southern California.
- Three administrative meetings will be required in Sacramento.
- Ten original copies of the final property value study will be produced for distribution as part of the "Power Grid and Land Use Policy Analysis".

We estimate the maximum fee for the complete study outlined to be in the amount of \$279,000. If only the residential portion of the study is advised, we estimate a fee of \$150,000.

REFERENCES

- (1) Appraisal Institute, The Appraisal of Real Estate, Tenth Edition (1992): 43, 178-181.
- (2) Appraisal Institute, *Standards of Professional Appraisal Practice of the Appraisal Institute*, "Guide Note 8: The Consideration of Hazardous Substances in the Appraisal Process" (effective January 1, 1991, amended January 28, 1994).
- (3) Appraisal Institute, *Property Observation Checklist* (1995).
- (4) Bank of America, *Environmental Checklist*.
- (5) Wells Fargo Bank, *Wells Fargo Environmental Property Inspection*.
- (6) Hsiang-te Kung, PhD, and Charles F. Seagle, "Impact of Power Transmission Lines on Property Values: A Case Study", *The Appraisal Journal* (July 1992): 413-418.
- (7) Randall Bell, "The Ten Standard Categories of Detrimental Conditions". *Right of Way* (July 1996): 14-16.
- (8) Randall Bell, "The Impact of Detrimental Conditions on Property Values", *The Appraisal Journal* (October 1998): 380-391.
- (9) Dr. William N. Kinnard, Jr., MAI, "Tower Lines and Residential Property Values", *The Appraisal Journal* (April 1967): 269-284.
- (I 0) Louie Reese, "The Puzzle of the Power Line", *The Appraisal Journal* (October 1967): 555-560.
- (I 1) R.E. Alleman, MAI, "On 'The Puzzle of the Power Line'", *The Appraisal Journal* (April 1968): 275-276.

ATTACHMENTS

EXCERPTS FROM RFP

Complicating Issues

The possible relationship between EMF exposure and property values is very complex. Stakeholder advisors of the CDHS have raised the following issues that a study should address. The proposal should discuss these issues and state how they are resolved by the proposed methods. If the problems cannot be resolved, the proposal should state how second best methods could be used and what their shortcomings are.

- 1) EMF exposure can be measured in different ways, e.g., by wire code; distance from the lines; measurements near the house; and in-house measurements. How will the study use these multiple exposure measures?
- 2) Different EMF exposure metrics have been proposed, e.g., time weighted average; thresholds; rapid changes. What is the feasibility of using these different measures?
- 3) It is possible that property values are affected more by perceived exposure than by actual exposure. How will the study address the difference between perceived and actual exposure?
- 4) Is it necessary to categorize homes in terms of aesthetics, noise and radio interference?
- 5) How will the study separate overhead and underground transmission and distribution lines?
- 6) How will the study assure blind categorization or measurement of the independent and dependent variables?
- 7) What sample size will be required to detect a 5% difference in property values (at an alpha level of .05 with sufficient power)?
- 8) How will the study address the three scenarios: research proves that there are no health effects; research proves that there are serious health effects; and research remains inconclusive?

ESTIMATED BUDGET SUMMARY

Budget Summary Outline

Meetings (3)

3 mtgs. x 2 staff x 6 hours x \$200/hour	\$ 7,200
Travel - Sacramento	1,200

Sin2le-Family Residential Studies (5)

Study/Control Area Research; Survey Questionnaire	
40 hours x \$200/hour.....	8,000
Market Data Research, Verification & Analysis of Data (5)	
3 x 100 hours x \$200/hour	60,000
2 x 120 hours x \$200/hour	48,000

Commercial/Industrial Property Studies (5)

Study/Control Property Identification	
60 hours x \$200/hour.....	12,000
Market Data Research, Verification & Analysis of Data	
3 x 40 hours x \$200/hour	24,000
2 x 60 hours x \$200/hour	24,000

Agricultural Land Studies (5)

Study/Control Property Identification	
40 hours x \$200/hour.....	8,000
Market Data Research, Verification & Analysis of Data	
5 x 40 hours x \$200/hour	40,000

Report Preparation

80 hours x \$200/hour.....	16,000
Miscellaneous Travel/Lodging,	5,000

Subtotal.....	\$253,400
Contingency @ 10%	25,340

Grand Total.....	\$278,740
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Say \$279,000

SCHEDULE OF PROFESSIONAL HOURLY RATES

Parkcenter Realty Advisors - Fee Schedule

Robert A. Steele, MAI, CRE	\$300/Hour*
Christopher N. Hardy, MAI	\$200/Hour
Clay S. Harris, MAI	\$200/Hour
Marian L. Lamb, Appraiser	\$175/Hour

* Applicable for Post-Appraisal Services, Deposition and Trial

PROFESSIONAL QUALIFICATIONS

PROFESSIONAL QUALIFICATIONS

MARIAN L. LAMB

Education: University of Southern California, Los Angeles Bachelor of Science (1975)

American Institute of Real Estate Appraisers
Courses 1A, 1B, 2 and 6.

Continuing Educational Seminars, Appraisal Institute

Employment: Vice President-PARKCENTER REALTY ADVISORS, 1982-Present
801 North Parkcenter Drive, Suite 210, Santa Ana, California
Providing, investment and marketing consulting services in the acquisition, sale, leasing, portfolio management valuation, land use and development planning of investment real estate. Clients include industrial corporations, development companies, investors financial institutions, governmental agencies and nonprofit organizations.

Valuation Officer-MCO EQUITIES, INC., Los Angeles, California, 1981-1982
Appraisal review, inspection and analysis of all types of real estate throughout the United States.

Senior Analyst-LEA ASSOCIATES, INC., Los Angeles, California, 1981
Provided appraisal services on a variety of property types.

Appraiser-COLDWELL BANKER MANAGEMENT CORP., Los Angeles, California. 1976-1981
Appraisal of shopping centers, office buildings, industrial properties, residential income. vacant land, subdivisions and proposed projects.

State Certification: Certified General Real Estate Appraiser
State of California Identification No. AGO 14566 (Valid until June 9, 2002)

PROFESSIONAL QUALIFICATIONS
ROBERT A. STEELE, MAI, CRE

Education: El Camino College, A.A., 1952
University of California at Los Angeles, B.S., 1954
University of Southern California, M.B.A., 1962

Employment: President, Parkcenter Realty Advisors, Santa Ana, California (1982-Present)
President, MCO Equities, Inc., Los Angeles, California (1981-1982)
Senior Vice President, Landauer Associates, Inc., Santa Ana, California (1975-1981)
Vice President, Co-Owner, Shattuck Company, Los Angeles and Santa Ana, California (1964-1975)
Employee, Shattuck Company, Los Angeles, California (1954-1964)

Professional Activities: Director, Pan American Properties (1973-1983)
Director, National Association of Realtors (1973-1978)
Director, California Association of Realtors (1971-1974)
Director, Los Angeles Board of Realtors (1971-1974)
President, Southern California Chapter, AIREA (1974)
Governor, Governing Council, AIREA (1975-1977), (1984-1986)
Governor, Board of Governors, ASPEC (1979-1981), (1982-1984)

State Certified Appraiser: California No. AGO06307-, Nevada No. 00628-A

Member: Appraisal Institute (MAI) California Association of Realtors
American Society- of Real Estate Counselors (CRE) East Orange County Board of Realtors
National Association of Realtors International Right-of-Way Association

Contributing Author: "The Impact of Civil Disobedience on Property Values", published by AIREA in *The Appraiser Journal* (July, 1968)
"Appraising Apartment Houses, Market Data Approach", published by California Real Estate Association in *Apartment Houses* (1968)
"Review of An Appraisal of Residential Subdivision Land", published by AIREA in *The Appraiser* (1969)
"The Appraisal of Residential Income Property, Narrative Appraisal Reports for Residential Income Proper", published by Southern California Chapter of AIREA (1971)
"Application of Equity Yield Analyses in Appraisal Reports", published by AIREA in *The Appraisal Journal* (April, 1975)
"The J Factor: A Valuable Ellwood Legacy", published by AIREA in *The Appraisal Journal* (October, 1978)
"DCP/Re Capitalization Rate Tables for Today's Financing", published by AIREA in *The Appraisal Journal* (January, 1981)
"Beware the Abusers of IRR Methodology", published by AIREA in *The Appraisal Journal* (April, 1982)
"Investment Analysis for Existing Projects", published by American Society of Real Estate Counselors in *Real Estate Counseling* (1984)
"A Recipe For Good Cash Flow Analysis", published by AIREA in *The Appraisal Journal* (April, 1989)
"How Interest Rates Affect Income - Property Returns", published by Commercial-Investment Real Estate Council in the *Commercial Investment Real Estate Journal* (Summer, 1989)

Teaching and Lecturing: Investment Analysis, AIREA Litigation Valuation, AIREA
Capitalization Theory and Techniques, AIREA Principles of Real Estate Appraisal,

UCLA Extension Urban Properties, AIREA Advanced Real Estate Appraisal, UCLA

Extension

Has appeared as a lecturer at various chapter, regional and national meetings and seminars of AIREA. Has lectured to various real estate board meetings and state conventions. Appeared as a panelist on ASREC national convention programs. Has been a speaker at various professional association conventions.

Academic Affiliations: Phi Kappa Phi, All University Academic Honorary, University of Southern California, 1963
Beta Gamma Sigma, School of Commerce, Academic Honorary, University of Southern California, 1963
Lambda Alpha, Land Economics Honorary Fraternity, 1980

PROFESSIONAL QUALIFICATIONS

CLAY S. HARRIS, MAI

Education: California State Polytechnic University, Pomona, California
Bachelor of Science - Finance/Real Estate, 1977.

Employment: Senior Vice President-PARKCENTER REALTY ADVISORS, 1982-Present
801 North Parkcenter Drive, Suite 210, Santa Ana, California
Providing investment and marketing consulting services in the acquisition, sale, leasing, portfolio management, valuation, land use and development planning of investment real estate. Clients include industrial corporations, development companies, investors financial institutions, Governmental agencies and non-profit organizations.

Vice President Valuation-MCO EQUITIES, INC., Los Angeles, 1981-1982
Appraisal review, inspection and analysis of all types of real estate, throughout the United States.

Associate-LANDAUER ASSOCIATES, INC., 1979-1981
515 North Cabrillo Park Drive, Santa Ana, California
Providing consultation and appraisal services for all types of investment real estate.

Appraiser-FINANCIAL APPRAISALS, INC., Los Angeles, California, 1977-1979
Appraisal of single-family residences, residential income, commercial real estate, vacant land, subdivisions and proposed construction.

Professional Organization: Member: Appraisal Institute (MAI)
Southern California Chapter, Elected Positions: Board of Directors, 1990-1992

Currently certified under the continuing education program of the Appraisal Institute.

Coursework: Successfully completed and passed the following courses and examinations as given by the American Institute of Real Estate Appraisers:

Course 8, Residential Valuation
Course 1A, Principles of Real Estate Appraisal
Course 1B, Capitalization Theory and Techniques
Course II, Urban Properties
Course VI, Real Estate Investment Analysis
Standards of Professional Practice
Institutes Comprehensive Examination

State Certification: Certified General Real Estate Appraiser; State of California
Identification No. AG003520 (Valid until October 3, 2000)

PROFESSIONAL QUALIFICATIONS

CHRISTOPHER N. HARDY, MAI

- Education: University of Redlands, Redlands, California
Bachelor of Science - Engineering (1972)
- Employment: Senior Vice President - PARKCENTER REALTY ADVISORS
801 North Parkcenter Drive, Suite 210, Santa Ana, California, 1982-Present
Providing investment and marketing consulting services in the acquisition, sale, leasing, portfolio management valuation, land use and development planning of investment real estate. Clients include industrial corporations, development companies, investors financial institutions, Governmental agencies and non-profit organizations.
- Vice President - LANDAUER ASSOCIATES, INC., Santa Ana, California, 1979-1982
Providing consultation and appraisal services for all types of investment real estate.
- Senior Valuation Engineer - INTERNAL REVENUE SERVICE
Los Angeles, California, 1972-1979.
- Professional Organizations: Member Appraisal Institute (ivtal)
- Southern California Chapter, Elected Positions:
President, 1993
Vice President, 1992
Secretary Treasurer, 1991
Board of Directors, 1989-1990
Assistant Secretary, 1988
- Currently certified under the continuing education program of the Appraisal Institute.
- State Certification: Certified General Real Estate Appraiser; State of California
No. AGO03369; Valid until April 3, 2000
- Coursework: Successfully completed and passed the following courses and examinations as given by the American Institute of Real Estate Appraisers:

Course IA, Principles of Real Estate Appraisal
Course I B, Capitalization Theory and Techniques
Course 11, Urban Properties
Course VI, Investment Analysis
Standards of Professional Practice
- Court Testimony: Expert Witness, United States Tax Court

PARKCENTER REALTY ADVISORS

Appraisers and Consultants

*801 North Parkcenter Drive
Suite 210
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(714) 547-11@33
(714) 972-1492 FAX*

April 12, 1999

DECISION INSIGHTS, INC.

2062 Business Center Drive, Suite 110
Irvine, California 92612

Attention: Dr. Detlof von Winterfeldt, Ph.D. President

Reference: Feasibility Study To Measure The Impact Of Electromagnetic Fields Exposure (EMF)
From Transmission And Distribution Lines On Property Values

PRA File No. 99-13-I

Dear Dr. von Winterfeldt:

We have received and carefully considered your March 29, 1999 critique of our proposal, "Feasibility Study To Measure The Impact Of Electromagnetic Fields Exposure (EMF) From Transmission And Distribution Lines On Property Values". Following are our responses to the seven main concerns listed, and clarification of some of the reasoning which went into our proposal dated March 12, 1999.

1. We are not familiar with utilization of the term "market value" to describe an appraisal methodology. As we have related in our proposal, we would anticipate utilizing the Sales Comparison and Income Approaches To Value as the primary appraisal methodologies, depending on the type of property to be addressed in a particular study. We have further stated that surveys and inter-views would be integral parts of our methodology, both in verification of the market data and in determining specific market sensitivities and concerns, if any, with respect to the EMF issues identified in the Request For Proposal (RFP). Perhaps there is some confusion of our use of these terms in the discussion of proposed methods on page 5 of the proposal.

In order to be clear, our reference to "interviews" and "surveys" does not contemplate a mass statistical study of hypothetical questions. Rather, the surveys would be part of the sales verification and research effort, specific to buyers, sellers, developers and brokers involved with sales of properties in the study and control groups. If, in fact,

the sales evidence shows that there is a negative impact on property values which is attributable to EMF issues, the results of the interviews and surveys would be the means of identifying the specific attitudes, concerns and apprehensions of the market participants which led to the lower sale prices.

2. Assessment of the impact on value of EMF variables such as distance, measured exposure, wire codes, types of structures and location of lines may be revealed by the attitudes and levels of awareness indicated by the surveys and interviews. Such reference was made in our proposal on page IO as part of the data analysis plan.
3. Once again, to the extent that any loss in value due to EMF exposure or proximity to transmission lines is supported by the market data, specific reasons for the loss in value as being attributable to EMF exposure or non-EMF effects may be revealed by the interview and survey data.
4. The perspective of our proposal reflects our background as analysts trained in the cratherina and analysis of factual market data. We are accustomed to dealing with evidence which reflects the attitudes and perceptions of buyers and sellers as of a particular point in time. By very definition, the concept of an "appraisal" and "market value" deal with an "estimate" of the most probable price" that a property will brin , reflecting market conditions as of a specified date. Thus, the study that we have outlined is certainly capable of measuring or estimating whether EMF exposure has had an impact on property values to date, as indicated by the existing market evidence.

Your request for a "determination" of the magnitude of effect on property value depending on the resolution of the research about an EMF-Health link is almost certain to be immeasurable from current market data and conditions because it deals with a hypothetical which heretofore has not specifically been experienced in the market.

5. Response to concern no. 5 is covered in our discussion of the other items.
6. It was not our intent that the study be tailored to meet scientific standards as defined by statistical analysis methodology. You asked for our recommendation as professional real estate appraisers, not scientists, as to how a valuation study could be conducted which would address a very broad range of issues concerning the impact of EMFs on property values. We responded based on our appraisal experience involving other types of environmentally challenged properties, which has shown us that the number of meaningful sales of study and control group properties, say within a tract of single-family residences, is likely to be very small. Thus, the very nature

DECISION INSIGHTS, INC
Attention: Dr. Detlof von Winterfeldt,

April 12, 1999
Ph.D. Page 3

of the data is not likely to be available in sufficient quantity or with sufficient identification of the impact that referenced variables have on value, to be viewed or handled as a valid statistical study.

7. We consider our review of published data, combined with our own appraisal experience, to be sufficient background for the proposal issued.

In the final analysis, we have reached the conclusion that we are not able to revise our proposal in a manner which will satisfy the concerns expressed in your critique. From our perspective, the reality is that it is unlikely that our appraisal study would fully address the issues raised nor would it provide answers in the level of the detail sought. This is primarily due to what we perceive as limitations to the data itself and in the level of awareness and sophistication of the market participants.

Respectfully submitted,

PARKCENTER REALTY ADVISORS

By:

Christopher N. Hardy, MM
Senior Vice President
Certified General Real Estate Appraiser
State of California No. AG003369

CNH:pmd

decision

insights

inc.

March 29, 1999
Mr. Christopher Hardy
Parkcenter Reality Advisors
801 North Parkcenter Drive
Suite 210
Santa Ana, CA 92705

Dear Christopher:

I forwarded your proposal "Feasibility Study to Measure the Impact of Electromagnetic Fields Exposure (EMF) from Transmission and Distribution Lines on Property Values" to Decision Insights' client, the California Department of Health Services. Drs. Raymond Neutra from the CDHS and Vincent DePizzo from the Public Health Institute reviewed the proposal. They came to the conclusion, which I share, that the proposal has not responded to important parts of the "Mock RfP" nor does it provide sufficient detail to judge whether the proposed study will give useful answers regarding an EMF-Property Values relationship. As a result, they have not forwarded the proposal to the stakeholders for comment.

Our main concerns are:

1. The RfP asked for a multi-method approach, and it explicitly mentioned three methods to be included (appraisal, market value, and survey). The proposal only considers one of these methods (appraisal method).
2. The RfP asked to assess property value impacts as a function of several variables, including exposure source, actual exposure, distance, types of structures, and location of lines. The proposal considers only distance from the line.
3. The RfP asked for an analysis of the relative magnitude of EMF exposure and non-EMF effects. The proposed makes no effort to address that distinction.
4. The RfP asked for a determination of the magnitude of the effect, depending on the resolution of the research about an EMF-Health link. The proposal makes no effort to address this issue.
5. The RfP listed several complicating issues and asked the proposing agency to discuss these issues and to state how they are resolved by the proposed methods. The RfP does not address these complicating issues.
6. The proposal does not meet scientific standards for study design (identification of independent and dependent variables, controls, sample sizes, and statistical analysis method).
7. The literature review indicates unfamiliarity with several of the major property values studies related to the power grid (see enclosed review by Gregory and von Winterfeldt, 1996).

These shortcomings are sufficiently serious that we would like to Oive you an opportunity to revise the proposal, before we consider a review by the stakeholder advisory committee (SAC). You may recall that the investor owned and municipal utilities of California are represented on the SAC and that their staff has substantial experience with property values studies. Other members of the SAC have also educated themselves about property valuation studies. They are likely to come to even harsher conclusions than the ones expressed in this letter.

This revision would be part of the first phase of the proposal development process, and should not be considered to be a response to the comments by the SAC. Thus, no additional payments would be made for this revision beyond the \$7,000 for the first phase. Please let me know if you think that you can provide a revision that adequately addresses the seven points listed above. We would need this revision within two weeks from receipt of this letter.

Sincerely,

Detlof von Winterfeldt
President

cc.: Dr. Raymond Neutra
Dr. Vincent DelPizzo

Proposal for

Feasibility Study to Estimate the Impacts on Property Values of EMF Exposure from Powerlines

Submitted to:

Detlof von Winterfeldt
Decision Insights, Inc.
2062 Business Center Drive, Suite 110
Irvine, California
U.S.A. 92612

Submitted by:

Robin Gregory

Decision Research & Value Scope Research
1124 West 19th Street

North Vancouver, B.C.

Canada V7P 1Z9

April 15, 1999

1.0. Introduction

This proposal is submitted in response to a "mock request for proposals" from Decision Insights, Inc. to define the main elements of a comprehensive study on the possible effects of exposure to electromagnetic fields (EMF) from power-frequency transmission or distribution lines on property values in the state of California. The overall purpose of this study is to provide information to policy makers at the California Department of Health Services regarding the potential magnitude of any EMF-related reduction in property values as well as the implications of public concerns for policy development or the selection of mitigation alternatives.

As suggested in the RFP, there are four main sections of this proposal: a theoretical framework, a brief summary of previous research, a description of the proposed study approach and empirical analysis, and an overview of the anticipated project cost and timeline. Main sources of information are referenced and noted in a separate section.

We note at the outset that the topic of possible reductions in property values as a result of perceived or actual exposure to EMFs is complex and challenging. We have attempted to provide sufficient context to introduce the principal study objectives and components. However, our focus is limited to presenting the outlines of a study that would assess the existence and magnitude of property value effects as the result of exposures to EMFs or of perceived risks from EMFs. Our expertise is in the areas of policy analysis, decision making, and survey design. To complete the proposed study successfully, additional experts in epidemiology, power systems engineering, economics, appraisal methodology, and psychology would need to be involved in the study.

2.0. Theoretical Framework

The origin of this study lies in the public concern regarding the possibility that exposure to EMFs may increase the risks of certain types of cancer or result in other harmful reproductive, developmental, or neurobiological effects. During the past 20 years, numerous epidemiological studies have examined the possible association between human health effects and exposure to EMFs. Although strong voices can be found in support of a wide variety of positions, most observers agree that the scientific evidence is mixed (e.g., see National Research Council, 1996). Furthermore, substantial controversy remains as to the biological mechanisms that may produce health effects from exposure to magnetic fields. One of the problems in determining possible cause-and-effect relationships is that EMF sources are nearly everywhere, including computers and household appliances, wiring and grounding systems in homes, and transformers, in addition to the common transmission and distribution lines.

Despite the mixed scientific results and the vague nature of a possible link between EMFs and human health effects, research has shown that a concern about exposure to EMFs exists among a portion of the public. In one recent study by the Harvard Center for Risk Analysis, for example, 38% of the respondents in a study of possible health hazards reported they were quite confident (7 or higher on a 10-point scale) that exposure to EMFs from large power lines is hazardous to people's health (Graham & Putnam, 1996). Substantially more information would be required, however, to translate results of this type into suggestions for policy initiatives: What is meant by "large power lines?" How are key words such as "exposure" and "hazard" being defined in terms of distance, time, or other criteria? To what extent do participants understand, or even care to understand, the possible mechanisms of exposure? Would these individuals' concerns result in a decreased willingness to pay for houses near to a transmission or distribution line?

There also exist concerns about the mixing of health-related effects of EMF exposure with other characteristics of transmission or distribution lines, including aesthetic considerations (e.g., towers or lines interfering with or obstructing views), worries about the low-level noise sometimes heard in the vicinity of lines,

and other possible effects such as interference with radio signals or the disruption of neighborhood space due to transmission-line corridors. Disentangling these different possible sources to the fullest extent possible requires the application of quite sophisticated study techniques and a careful experimental design.

Additional questions concern the possible lack of a clear linkage between technical estimates of EMF exposure levels, as based on engineering studies or the results of sophisticated measurements, and perceived levels of EMF risk or exposure, as based on public citizens' beliefs about the presence or absence of important contributing factors (Slovic, 1987). However, it is worth remembering in this context that property values are established through open markets which depend on people's perceptions and attitudes. These perceptions relate both to people's beliefs about the present and their expectations regarding the future. In particular, property values are closely related to the market-based perceptions held by potential buyers. As a result, any fears affecting the security of a home purchase, including worries about EMF exposure, can lead to a reduction in the price that buyers are willing to pay. At the extreme, such negative perceptions can be inflamed by media attention and lead to properties being stigmatized (Gregory, Flynn & Slovic, 1995). Several additional effects on property values associated with EMF-related fears could then result, including a reduction in the pool of interested buyers, a widespread concern about the trend of sale prices over time, or (for example, if tests of EMF exposure levels were required as part of standard transactions) an increase in the costs of selling.

Another important influence of EMF concerns on property values is how individual homebuyers or sellers respond to uncertainty over time. Simply knowing that linkages between EMF-exposures and health risks are under study could serve to increase the uncertainty with which real-estate markets view long term price changes, even if reports demonstrate decidedly mixed results. Although there is no simple causal relationship between uncertainty and price devaluation, recent evidence suggesting that negative media reports may be more salient than positive reports over the long-run carries the potential for an adverse effect of uncertainty on property values over time (Flynn et al., 1998).

These are important issues, because the social and engineering costs associated with policy actions to reduce EMF exposure are substantial. Florig (1992) estimated that in the U.S. about 1 million homes are close enough to transmission lines that they are likely to show EMF levels higher than the average residential home levels of 0.5 - 1.0 milligauss (mG). In California, approximately 3,000 miles of transmission lines run through residential neighborhoods (Impact Assessment, 1998). Assuming 50 homes per mile on each side of the line, an average home value of \$175,000, and an average depreciation of 5%, this translates into a total property value reduction of \$2.6 billion.

Of course, the costs of mitigating against these property value reductions are also high. For example, undergrounding high voltage transmission line can cost upwards of \$4 million per mile. Thus undergrounding all 3,000 miles of residential transmission lines in California would cost \$12 billion or more. As a result, recommendations to undertake expensive mitigation initiatives can

only be made responsibly if the opportunity costs (associated with using the resources in this way) are understood and there is a high probability that the objectives of the mitigation effort will be met.

3.0 Review of previous research

Several studies examined the question whether the values of properties in the vicinity of powerlines are reduced as a result of public concerns about EMF-induced health effects. The bottom line, however, is that much of this evidence remains inconclusive and partial: only a small percentage of the studies were carefully conducted, and even fewer attempted to introduce controls that would help to distinguish the effects of EMF exposure from other possible sources of property-value reductions.

In their review of the literature on the property-value effects of EMF exposure from powerlines, Gregory and von Winterfeldt (1996) distinguished between studies conducted prior to 1979 (the publication date of Wertheimer and Leeper's study, which first linked EMF exposure from powerlines to possible human-health effects) and those conducted after 1979. Only two of the pre-1979 studies were found to be

methodologically sound (Colwell and Foley, 1979; Boyer et al., 1978), and both concluded that proximity to transmission lines negatively affected property values. Neither of these studies, however, controlled for EMF effects as compared to other possible sources of devaluation. And because of the dynamic nature of individuals' perceptions of the health risks of EMF exposure, it is unlikely that studies completed more than 20 years ago are able to provide much guidance for today's (or tomorrow's) policymakers.

The post-1979 studies, taken as a whole, provide weak evidence for a negative effect of powerlines on property values. For example, average declines of 5-10% were found in about one-half of the studies reviewed by Kroll and Priestley (1992). Overall, attitudinal studies (which attempt to directly capture public perceptions) typically show a larger drop in value than studies of actual market sales, which suggests that other considerations may enter the picture as an individual moves from a hypothetical to a real cash decision. There is also some evidence that initial impacts (i.e., shortly after a line's construction or extension) decline over time as the market adjusts.

Only a few of the post-1979 studies address the key question of multiple sources of property devaluation associated with powerlines. One of the best studies, by Hamilton and Schwann (1995), examines the effects of proximity to transmission lines on the sale prices of 12,907 single, detached dwellings in Vancouver, Canada during the period 1985-1991. Using carefully designed regression analyses to separate the influence of various factors, Hamilton and Schwann conclude that proximity to transmission lines is statistically significant, with a move from a house adjacent to a line to one 100 meters distant increasing property value by 5.8%. Removing the visual unsightliness created by transmission line towers is also significant, resulting in a property value increase of 5.7%. Removing both the visual effects of towers and the effects of proximity led to an increase in value for 100 meters of 6.3%.

4.0 Description of empirical approaches

Identifying the possible impacts of exposure to EMFs on property values is a difficult and complex task. The topic is also controversial, which means that any empirical research approach will be subject to great scrutiny. We see little merit in conducting yet another partial study that will not survive careful review. Instead, we suggest an ambitious program of research that will attempt to build on state-of-the-art techniques and provide new insights for policy makers regarding the possible link between EMF exposure from powerlines and property values. This section discusses three key issues in the development of such studies:

- problematic design issues;
- development of realistic future scenarios;
- utilization of multiple methods.

4.1 Problematic design issues

As noted in the previous review section, a large number of issues need to be addressed thoughtfully in order for the results of any study of the implications of EMFs on property values to be useful for policy makers or to be put into perspective by homeowners. These issues include the following six concerns.

1. How should the magnitude of possible exposure to EMFs be determined?

This one issue really holds three different questions. First, there are a variety of building stocks, including residential, commercial, and industrial structures, and the property value implications of EMF exposure need to be separated across at least these three building types. Second, there exist a variety of measurement approaches for estimating EMF exposures, including direct measurement (i.e., with a hand-held meter), distance from powerlines, or wire codes. Third, there exist a variety of measurement protocols and ways to provide information on the precision of an exposure estimate. For example, houses could be classified in terms of most-likely exposures expressed in mG, in terms of ranges or probability distributions of anticipated exposures, or in terms of category judgments (e.g., VHCC or very high current configuration vs. VLCC or very low current configurations).

2. What is the relevant definition of land uses?

A typical split is between residential, commercial, and industrial lands. Yet these divisions appear less clear upon close examination. For example, it might be important to separate residential properties into single-family homes, apartments, mobile homes, and retirement homes (following the hypothesis that owner-occupied housing might be more likely to exhibit a loss in value due to EMF-exposure concerns). Similarly, commercial space could be subdivided into governmental and institutional buildings, schools or hospitals, and retail space (with schools likely to be a particular concern). Another question concerns the relation of building configurations to EMF measurements. For example, should measurements of the proximity of powerlines in residential neighborhoods distinguish between distances from the front as compared to the back of houses? Should subdivisions of tract houses be treated differently from neighborhoods with wider spacing between houses? It also is not clear whether agricultural lands proximate to powerlines should be included in the analysis (a question that depends, in part, on whether concerns exist regarding the effects of EMF exposure to food crops, dairy farms, and the like).

3. What type of electrical line is under consideration?

Four main distinctions exist between types of powerlines: underground vs. overhead, and transmission vs. distribution. Yet more subtle distinctions also can prove important. For example, the height of overhead lines and the depth of underground lines can vary substantially, which in turn may affect perceived or measured exposure levels. Similarly, the configuration of overhead lines can vary substantially, with some options (e.g., compact delta configurations) costing more but resulting in reduced exposure levels. In addition, the current carried by transmission lines can vary considerably, which in turn can affect both perceived and measured levels of EMF exposure.

4. What type of structures are used in an area?

A variety of different options exist for line support structures (e.g., lattice structures vs. poles) and this choice can lead to significant implications for aesthetic considerations as well as result in differences in land-use restrictions and EMF exposure levels.

5. Where are the lines located?

As a general rule, lines are either placed along streets and roads or along a designated corridor right of way. The choice can influence the proximity of powerlines to houses as well as the visibility and appearance of the lines. Right-of-Ways also provide open space that may ameliorate the negative visual effects of towers and lines.

6. What is the primary source of effects?

As noted in the previous section, this has been a troubling issue since research into a possible EMF-health link began 20 years ago. The central challenge is to disentangle the property-value effects of EMFs from other effects that might be due, for example, to the aesthetics of lines, to noise levels, or to the existence of radio interference and then to estimate the relative magnitude of these effects. Underlying the question of sources and their magnitude is the question of how people perceive EMF effects to be transmitted and how effective different mitigation options are thought to be. For example, if EMF exposure is viewed in the context of an interference model (MacGregor, Slovic & Morgan, 1994), in which EMF exposure somehow interferes with the normal activity of the body, then the effects of different EMF measures and engineering safeguards on property values could differ substantially from what expert judgments suggest should be the case.

4.2 Development of realistic future scenarios

This issue concerns how beliefs about EMFs as they relate to property values are likely to change over the next 5, 20, or 50 years. It is important to keep in mind that the first studies showing a possible linkage between human health effects and proximity to powerlines were published twenty years ago. Research continues into this possible connection (Palfreman, 1996), but at present most researchers would agree that many of the underlying questions have not been answered.

There are at least three major ways in which the issue of the health effects of EMFs could be resolved:

- a) *it is conclusively shown that the EMF-health risk link does not to exist,*
- b) *it is conclusively shown that the EMF-health risk link does exist.* Two scenarios are possible: (b1) this link shows a low risk (e.g., on the order of 1 in 1 00,000 increase in the annual individual cancer risk), or (b2) this link shows a high risk (e.g., on the order of 1 in 1,000 increase in the annual individual cancer risk);
- c) *research about the EMF-health risk link remains inconclusive.* Two scenarios also are possible here: (c1) the EMF-health risk link is no longer an issue that captures much public attention, (c2) the issue still captures public attention and concern.

The differences between these scenarios are substantial and need to be factored into the design of study alternatives because they lead to the creation of quite different mental models of exposure and mitigation attractiveness (Bostrom, Fischhoff & Morgan, 1992). As one example, consider the question of how potential homebuyers are likely to respond to an EMF measurement conducted in a house. If Scenario c1 is in effect, then a moderate EMF reading of 1.5 - 2.0 MG is unlikely to significantly deter a potential buyer. However, if Scenario b2 is in effect, then even a moderate EMF reading could comprise a "detrimental condition" that adversely impacts real estate values by leading to heightened public concerns, a decline in selling prices, and perhaps a call for expensive mitigation measures.

As another example, consider a study that evaluates the correlation between property value decreases and both the aesthetic and EMF-exposure effects of powerlines. Under Scenarios a or c1, the correlation is likely to be largely due to aesthetic concerns, so that mitigation to reduce EMF exposures through splitting of the cables (which reduces EMF exposure by as much as 80% but increases the visibility of lines) is unlikely to be favored. However, under Scenarios b2 or c2, for which the correlation is likely to be largely due to exposure concerns, a mitigation initiative to reduce EMF exposures through splitting cables will be more popular and may be required in many neighborhoods.

4.3 Comparison of results from multiple methods

In the case of complex and controversial policy issues, it is typically recommended to conduct parallel studies that utilize several different research methodologies. The request for proposals notes three options, all of which (in our opinion) should be undertaken; these are briefly discussed below.

Study 1: Appraisal study. This study would establish a multidimensional basis for comparing the stock of properties and then compare the selling prices of properties near to powerlines (e.g., adjacent, **less** than 100 m, less than 200 m) to the prices of properties that are similar in all ways except for their increased distance from a powerline (i.e., a control group). This can be visualized as a large matrix, with different property types across the top (e.g., residential, commercial, and industrial properties) and the set of relevant characteristics along the side (e.g., measured EMF exposure, distance from powerlines, or wire codes; visibility of different tower types, noise levels, etc).

Although the basic methodology is straightforward, determining the relevant information on property characteristics and then developing the required data base is a significant task, in part because a sufficient number of entries need to be found for each cell in the matrix. For example, it may be necessary to compare results across 3 or 4 sample areas for each of the main types of land uses. To the extent that early results show significant differences across land uses, for example between the property value effects on residential and commercial structures or between urban and rural properties, then it may be necessary to increase the sample size by obtaining supplementary sales data from other areas. In addition, decisions will need to be made regarding the need for additional information (e.g., regarding the average number of days that houses were on the market prior to selling), which could be provided through buyer and seller verification interviews.

It would be desirable to be able to detect a 1 % property difference between comparable homes. If all extraneous factors are controlled, this could be achieved with a sample size of 200 paired homes. Of course, including other independent variables such as neighborhood characteristics, aesthetics, and types of structures will increase the required sample size substantially.

Study 2: Market values. This method would use statistical techniques to evaluate historical records of property sales based on a hedonic approach that distinguishes between characteristics influencing property values. Numerous examples exist of hedonic methods being used to evaluate the effects of reported hazards on property values (e.g., Nelson, Genereux & Genereux, 1992). In the context of EMF effects, one option would be to use distance as a proxy for exposure and plot each sale on a map (to calculate distance to the center of a transmission line right-of-way), thereby dividing properties into three or four categories (e.g., those adjacent to a line, those within 50-100 meters, and those more than 100 m from a powerline). Another option, for a subset of the properties, would be to measure EMF exposures directly (e.g., using a meter or through wire codes). Standard regression techniques could then be used to separate the contributions of a variety of possible factors (i.e., independent variables) that might exert an influence on property values, including

- a standard listing of property characteristics (e.g., lot size, square footage of house, whether corner lot, age of property, number of bedrooms, number of baths, number of other rooms, presence of garage, pool, fireplace, sewer type, etc.);
- relevant neighborhood characteristics (e.g., access to schools, shopping);
- the number and type of towers visible from the property
- the measured level of noise experienced at each property
- the anticipated presence of interference with radio signals.

Such hedonic approaches are widely used, and a straightforward calculation can be made to estimate the minimum sample sizes that are needed to achieve a sufficient level of confidence (i.e., power) in the results. Hamilton and Schwann achieved a remarkable degree of precision with 12,907 sampled homes. More difficult are decisions regarding the functional specification of the equations. As noted in the paper by Hamilton and Schwann (1995), the improper use of linear or log-linear specifications can yield faulty results and tests need to be conducted to determine whether the functional form of the regression should vary for properties at different distances from the powerlines. Close attention also has to be given to other aspects of the econometric work, such as possible corrections for heteroscedasticity in the error term in hedonic equations.

Study 3: Survey methods. A survey of potential buyers could establish a base level of knowledge regarding EMF effects and provide useful information about individual's understanding of the cost and efficacy of alternative mitigation options (e.g., reconfiguring vs. undergrounding lines) as well as their understanding of EMF-exposure sources (e.g., do people understand that grounding for homes via water pipes produces EMF exposure?).

One important advantage of survey methods relative to appraisal or market studies, for example, is that hypothetical and future-oriented questions can be asked, rather than having to rely on historical data. Another advantage is that specific questions can be asked to gain a better understanding of the reasoning behind individuals' perceptions of the possible health effects of EMF exposure. For example (as noted earlier), several researchers have discussed the prevalence of an interference model of EMF health effects. In the context of this naive model, it is not clear how homeowners might view the efficacy of an option such as undergrounding transmission lines, nor is it clear how they might respond to risk communication initiatives that explain the possible reductions in EMF exposure based on the results of biological tests of various mitigation options (MacGregor, Slovic & Morgan, 1994). Although such studies of risk perception would not be the focus for the proposed research effort, it would at minimum be helpful to ask questions of participants relating to specific proposed mitigation initiatives.

Following standard procedures, a survey would begin by holding focus-group sessions to identify and refine designers' understanding of key issues and, after drafting an initial survey Instrument, move on to pilot testing sessions that would result in changes to the overall design. In light of the complexity of issues relating to the possibility of EMF-related health effects, we recommend that these initial small-group sessions follow a structured decision process along the lines of what typically constitutes the first part of a multiattribute utility study. This additional rigor would be required to successfully (a) identify key considerations and objectives relevant to the effects of powerlines on property values, (b) discuss issues of EMF measurement, land use options, and tower visibility and provide reasons for expressed preferences, (c) determine to what extent participants could separate the effects of EMF exposure from other sources of concern, and (d) identify and rate different mitigation options for reducing EMF exposure. The small groups also could address other issues relevant to the link between EMF exposure and property values, such as environmental justice concerns (e.g., whether more lines will be placed underground in wealthy neighborhoods because homeowners are able to cover the costs) and the relation between individuals' perceptions (i.e., worry and fear) and engineering mitigation measures to reduce EMF exposure levels.

So long as sufficient numbers of completed surveys are available, survey results permit an accurate statistical analysis of findings for designated subgroups. For example, comparisons could be made across key stakeholder groups such as a random sample of urban vs. rural homebuyers, or buyers in a location with high EMF concern vs. buyers in a location with low EMF concern (in this regard, techniques such as over-sampling of key populations are common). A disadvantage of many surveys, however, is that questions are asked at a sufficiently generalized level that the results are difficult to interpret from the context of specific mitigation or policy recommendations. One of the reasons for this is that, for unfamiliar and complex (i.e., multidimensional) decisions, it now appears that surveys may not so much reveal a latent opinion as they construct a response on the basis of the context within which a question is asked and the cues provided as part of the specified judgment task. This emerging approach is typically referred to a conceptualization of "constructed preferences" (Payne, Bettman, & Johnson, 1992). Following the constructive line of thinking, the way to improve the quality of an expressed preference or attitude is to use a survey

procedure that can build a clear expression of value, one that addresses three fundamental decision steps of (a) framing the decision, (b) defining key objectives, and (c) identifying tradeoffs among objectives.

One attractive survey option, as described in Gregory et al. (1997), is to employ a decision-pathway approach that includes questions designed to remind respondents of the multiplicity of values, and diversity of benefits and costs, that they might hold. To ease cognitive overload, it asks questions about parts of the problem before asking about the whole problem and provides respondents with a variety of decision options, recording the path the respondent establishes. Thus, not all respondents answer the same questions. Instead, each pathway is designed to match a particular mental framework, and different answers to an earlier question lead to different sets (pathways) of subsequent questions. But all paths lead to the same final question(s) - the decision(s) it is most important for the respondent to address.

5.0 Anticipated project cost and timeline

This section provides additional details on the anticipated cost of component projects and a reasonable study timetable. As described below, total costs for the three main study components are expected to total approximately \$800,000. Note that this estimate does not include any additional personnel, data collection, or analysis costs associated with the important task of coordination across projects.

5.1 Estimated costs of studies

The costs for a project of this type are difficult to anticipate with precision, for several reasons. One is simply the overall complexity of the study, which will be required to have many parts that will be conducted simultaneously by different consultants (or sub-consultants). For example, as outlined in the previous section, a successful study is likely to require the adoption of three or four different approaches to estimating the property value effects of EMFs. For a survey approach, it also will be necessary to examine the impact of the three different future scenarios on respondents' perceptions of how different levels of EMF exposure could affect property values. A summary of these various study options and their estimated costs is shown in Figure 1.

Both the appraisal study and the market value study will face critical questions of data identification, quality, and availability. For example, registered data on sales is unlikely to include information on considerations such as noise levels or radio interference. As a result, data analyses comparing properties near powerlines to those farther away will probably need to be supplemented with buyer-seller sales verification interviews and/or questionnaires provided to real estate agents in the relevant areas, which will increase the expense of such studies. An estimated cost for the appraisal study of \$200,000, based on the costs of similar studies and an estimated cost of \$75 for each of 500 interviews.

The market value study is likely to be more demanding of data than any of the other approaches, because of the requirements of the statistical analyses for sufficient entries in each of the designated categories. Collection of the required information will again require the analysis of sales data supplemented with the results of personal interviews. Solution of the many tough econometric questions will require careful thought and is likely to be demanding of the consultant's time. Costs are estimated to be about \$175,000.

Survey methods also will need to be responsive to the range and type of issues that arise as part of the initial scoping sessions. The survey option is estimated to cost approximately \$350,000, including conduct of the initial structured small group sessions and analysis of the survey as well as its implementation. Design of the survey would require an estimated 4 person-months of work, including conduct of the focus groups that are described in Section 3; analysis of the data, and presentation of the final survey results, would require an estimated 3 additional person months of effort. Typically, implementation of a survey of this type would be contracted out to a survey firm, which would use trained operators to complete a random sample telephone survey requiring perhaps 1600 completed responses. This number of completed surveys would allow for statistically significant comparisons, with a confidence level of approximately +/- 5%, to be made across four or more subgroups selected from the sample. The questions could be asked using a CATI (Computer Assisted Telephone Interview) format, which allows immediate access to a branching question structure and facilitates the completion of simple data analysis (e.g., frequency distributions of responses). At a cost of approximately \$65 per completed survey, survey implementation costs alone would be approximately \$1 00,000 (or about 30% of the total.)

5.2 Experts Workshop

In our opinion, both the cost and the the complexity of the overall study argue strongly in favor of a one- or two-day workshop at the start of the study process that will include experts from a variety of disciplines, including leading property appraisers, econometricians, survey design experts, EMF-mitigation engineers, and epidimeologists drawn from throughout the U.S. The purpose of the workshop would be to review alternative study designs and critically examine both (a) their ability to provide the desired results and (b) the confidence held in the cost and timeline estimates. This group of experts should not require many initial materials other than an overview of the study design; participant numbers should be kept small (e.g., 10-12 people) to facilitate effective communication.

Costs of the expert workshop are estimated at \$75,000, based on payments to participating individuals of \$3 - 5,000 along with required travel costs and associated expenditures.

5.3 Stakeholder advisory committee

Another key to the overall success of the study effort will be the ability of all consultants to work successful over time with the Stakeholder Advisory Committee. However, no costs are estimated for this committee because its functions are assumed to be ongoing and its expenses are assumed to be covered from a separate budget.

5.4 Schedule

We anticipate that each of the four components of this proposed study could be completed within approximately one year of the start of the contracts. This is shown in Figure 2, which provides a timeline for the different study components. Note that this timeline assumes that prior meetings will be held with the Stakeholder Advisory Committee and that the results of the Experts Workshop will be factored into decisions made by the contractor in the selection of consultants and in the requested study designs.

6.0 Conclusion

The primary objective of this proposal is to provide guidance to policy makers regarding the anticipated consequences and public acceptance of potential mitigation options. The overall study plan that we propose is ambitious, but the problem of predicting the property value effects of EMF powerline exposure is both challenging and complex. Some type of multi-method approach is needed, we believe, to provide different perspectives on the relationship between EMF exposure and property values and to establish sufficient convergent (acrossstudy) validity. The active participation of a diverse set of stakeholders also is necessary, for without open design of the studies and unbiased peer review, the results are unlikely to prove acceptable. This is particularly true in an area such as this, where the underlying science remains controversial and where so much of the previous work on property value effects of proximity to powerlines has examined only a small part of the large (multi-factor) picture. As a result, some of this previous work is inconclusive and has done little to lend insight to policymakers or understanding to concerned homeowners. From the standpoint of both citizen and utilities, therefore, it seems advisable to invest the time and resources that are necessary to achieve a higher level of confidence in the findings of studies.

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Figure 1: Principal Study Components

	Type of Study	Proposed Duration	Estimated Cost
1	Appraisal study	12 months	\$200,000
2.	Market values study	18 months	\$175,000
3.	Structured survey	18 months	\$350,000
4.	Experts workshop	1-2 days	\$ 75,000
		24 months (parallel studies)	\$8001000*

Does not include costs for personnel, data collection, or analysis associated with coordination across study components.

Figure 2: Study Timeline

	1999	2000			2001
	September - December	January - March	March - June	June - December	January - June
1. Appraisal study	Draft request for proposals, select coordinator and consultants	Study Design	Collect sales data and	Analysis and reporting of	
2. Market value study		Design study	Collect data and assess analysis options	Analysis of data	Reporting of results
3. Structured survey		Structured small-group sessions	Initial survey design and pretests	Redesign of survey and implement	Analysis and reporting of results
4. Experts Workshop	Workshop and report				